

National 4 and 5 Chemistry: Assignment

Resource pack: Hydrogels



This pack provides support and background information for the Coursework assessment or Added Value element of the Course.

The following key areas are supported by this pack:

Atomic structure and bonding related to properties of materials

- ◆ Physical properties of chemicals explained through bonding

Everyday consumer products

- ◆ Functional groups in alcohols, carboxylic acids

Properties of plastics

- ◆ Addition and condensation polymerisation including polythene and polyesters
- ◆ Representation of the structure of monomers and polymers, natural polymers

Hydrogels

In this Unit the learners will be asked to research/investigate the uses and/or properties of hydrogels. Hydrogels are presently used in many products available in High Street shops for medical, horticultural and cosmetic uses (search 'hydrogel' or 'aquagel' on the internet.) They are also used to make artificial snow for special effects in films and TV (search 'snowbusiness').

Hydrogels are a group of polymeric materials where the major constituent is water. They can be made from variety of substances, as described in the Wikipedia extract (search 'hydrogels').

Should you choose the option of practical work, an instruction sheet will be given. The practical work is not assessed and the data collected will count as one of the reference sources. The following practicals may be used unaltered or by adapting them to suit individual needs.

Starter materials

Many are available, here are a few.

- ◆ Search - 'How Many Balls Can You See? - QI - Series 9 Episode 12 - BBC Two'.
- ◆ There was also a demo of using the hydrogel from a nappy for snow making in the Christmas 2012 episode of QI.
- ◆ Search 'weirdsciencekids<<http://weirdsciencekids.com/OilspillexperimentPolymer.html>> OilspillexperimentPolymer" : hydrogel experiment for clearing up oil spills.
- ◆ Search — 'Weirdsciencekids and wtergel' :absorbency of hydrogel.
- ◆ <http://www.bbc.co.uk/news/science-environment-18477088>
- ◆ <http://meeting.aps.org/Meeting/MAR12/Event/166127> paper from 2012 describing the use in soils. A report on Rio 20+. Use of hydrogel to release moisture gradually from soil.

Useful search terms

- ◆ Hydrogel — Wikipedia has a full article on this.
- ◆ Aquagel.
- ◆ Snowbusiness – a company specialising in snow effects for TV and film.
- ◆ Weirdsciencekids – website aimed at pupil level.
- ◆ Newspaper report: *ScienceDaily* (Mar. 5, 2012) — University of California, San Diego bioengineers have developed a self-healing hydrogel that binds in seconds, as easily as Velcro, and forms a bond strong enough to withstand repeated stretching. The material has numerous potential applications, including medical sutures, targeted drug delivery, industrial sealants and self-healing plastics, a team of UC San Diego Jacobs School of Engineering researchers reported March 5 in the online Early Edition of the *Proceedings of the National Academy of Sciences*. Visited July 2012.
- ◆ RSC, New TalkChemistry and LearnChemistry

Investigations

A few examples of possible investigations are given below. The list is not exhaustive and other areas may be investigated.

Investigation	Research	Experimental activities	Comment
Absorbency of hydrogels: in nappies (or hair gel).	Investigate the benefits of using hydrogel rather than traditional liners in nappies. Nappies can be recycled. Research why this is important. Research the properties of hydrogels in relation to their structure and bonding.	Look at the effect of salt in hydrogels (RSC materials) Measure rate of water absorbency in hydrogels. Relative absorbance of other liquids e.g. alcohols, veg oil Weight loss against time of hydrogels in different hair gels.	These investigations can be used to enhance the teaching of ionic and covalent bonding, or hydrogels can be considered as an interesting polymer as well as an example of a smart material. Hydrogels are smart materials because they change shape when there is a change in their environment – in this case it is the change in the concentration of ions.
Uses of hydrogels in soils: for water retention, and other uses.	Can hydrogels be used to absorb nutrient-enriched water?	Look at water absorbency of hydrogel with different concentrations of fertilisers, or with different fertilisers.	Students need to have some
Uses of hydrogels in medicine: for water retention, and other uses.	Research the use of hydrogels in any medical area, eg contact lenses, burns dressings, wound closures.	Look at water absorbency of hydrogel with different dressings	knowledge and understanding of ionic and covalent bonding, reversible reactions, and acids and bases to understand what is happening.

Learner information

Before chemists start planning experimental work, they will always check to find out what is already known about a topic by reviewing the current literature.

Using the internet for background research

The web allows you to access a huge amount of information.

Make sure that you remain focused as you carry out your research. It is very easy to get side-tracked. Keep reminding yourself what you are trying to find out as you research.

Interesting, but not relevant, sites can be visited later. Sites that seem to be promising can be bookmarked so that they can be returned to later.

Tables, graphs and pictures can be copied into a folder. It is likely that some will be used and some will not.

It is worthwhile spending a few moments considering what keywords may best be entered into your search engine.

The web contains many sites with reliable information — but inevitably some data is unreliable. How can we know what is reliable? As a general rule, information that is not attributed to a source is likely to be unreliable. Professional and government sites are useful, however other online sources may be less reliable. Often it is quite easy to access the same data from a number of sites. This doesn't guarantee the reliability of the information, but it does help.